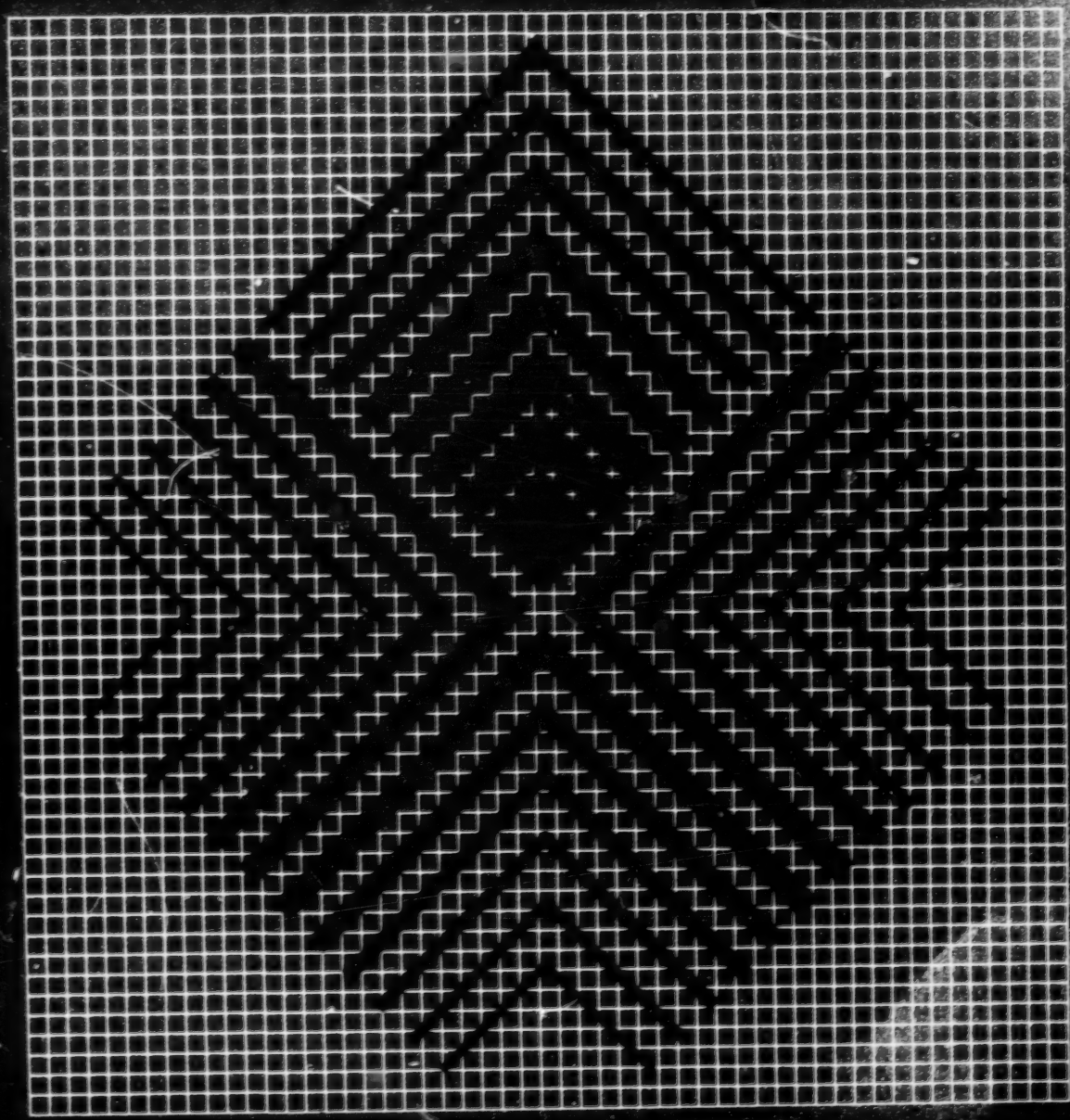
MANPOWER REQUIREMENTS IN THE HIGH TECHNOLOGY ELECTRONICS INDUSTRY IN ONTARIO:

1981-1985



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1981-1985

Ontario Manpower Commission

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INTRODUCTION

Despite the fact that the industries of North America, Western Europe and Japan have already begun to compete vigorously for the manufacture and most effective application of microelectronics, there are differences as to the extent of development in each geographical and technical area. The high technology electronics industry in Ontario is in the comparatively early stages of growth, though it is growing rapidly and is expected to continue to experience high growth rates over the next five to ten years.

The expected high growth has raised some concerns amongst educational and manpower planners as to whether the availability of qualified manpower will be sufficient to meet the expected demand. In order to assist policy makers in formulating appropriate manpower strategies, the Ontario Manpower Commission undertook several studies to provide information appropriate for projecting manpower requirements to 1985.[1]

Based on a survey of manufacturing firms producing high technology products, this study, entitled "Manpower Requirements in the High Technology Electronics Industry in Ontario: 1981-1985", concentrated on manpower requirements in the high technology electronics industry, as defined in Chapter I. Since a similar study was completed recently by the Community Industrial Training Committee in Ottawa, that geographic area was excluded from the survey. Manpower requirements were defined in terms of professional staff, technical staff, and production workers.

The specific objectives of the study were as follows:

i) to obtain descriptive information on the characteristics of establishments engaged in the high technology electronics industry;

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[1] Professional and Technical Manpower Requirements and Supplies in the Microelectronics Industry in Ontario: 1981-1985, Ontario Manpower Commission, May, 1981.

ii) to obtain quantitative estimates on current and projected employment for selected professional and technical job categories as well as for production workers;

iii) to obtain information on current and projected shortages for selected occupations and perceived factors contributing to shortages;

iv) to identify current sources of supply.

Canadian Facts was commissioned to undertake the data collection and processing, as well as the preparation of a summary of the findings; the Ontario Manpower Commission undertook the analysis.

This report contains a detailed analysis of the characteristics of the responding companies, their recent (Spring, 1981) and projected occupational employment, sources of supply of the different occupational groups, and specific hiring difficulties. It reveals some interesting trends on future manpower requirements, as well as substantial employment growth rates for each of the occupations.

I. EMPLOYMENT CHARACTERISTICS OF THE RESPONDING FIRMS

This chapter provides descriptive information on the characteristics of the surveyed establishments engaged in the high technology electronics industry.

1.1 Industry Definition

The high technology industry, for the purposes of this study, includes those establishments engaged in manufacturing electronic component assemblies or final electronic products. To be included in the study, each establishment had to be involved in the manufacture of at least one of the following product lines:

i) Telephone and telecommunications equipment (e.g., telephone exchanges and instruments, radio, radar, broadcasting studio equipment);

ii) Communications equipment, other than telephone (e.g., process control systems, video data terminals, antenna communications);

iii) Scientific, engineering and medical equipment (e.g., geophysical instruments, pacemakers, nuclear instruments, X-ray equipment);

iv) Computing and related equipment (e.g., micro computers, industrial data terminals, word processing equipment); and

v) Electronic components (e.g., recording equipment, printed circuit boards, electronic transformers).

In Ontario, outside of the Ottawa area, 193 such establishments were identified, primarily in the Toronto and Kitchener/ Waterloo areas. Of these establishments, 77 responded to the study providing current, historical and projected employment data, as well

as other information pertaining to the industry's future manpower requirements.

1.2 Location, Size of Establishment, and Product Line

As indicated in Table 1, the majority (62 per cent) of the 77 reporting firms were located in the Metropolitan Toronto area, 12 per cent in the Kitchener/Waterloo area and the remaining 26 per cent in other parts of the province (except Ottawa).[1] Total employment represented by these firms at the time of the survey was 12,566 employees.

More than half of all employees in the industry, as represented by the responding firms, were located in parts of Ontario outside of the Toronto and Kitchener/Waterloo area. While the Toronto area was the location for the majority of firms, it had a disproportionately small share of total employees in the industry. The Kitchener/Waterloo area, on the other hand, had the least number of firms, as well as the least number of employees.

With regard to firm size, 69 per cent of the firms surveyed had fewer than 100 employees, 26 per cent had between 100 and 499 employees, and the remaining 5 per cent were larger firms with 500 employees or more. The 5 per cent of firms classified as having 500 employees or more had over 50 per cent of the total reported employment. Since these larger firms were located elsewhere in Ontario, the number of employees in the Toronto and Kitchener/Waterloo areas was comparatively small.

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[1] For the purposes of this study, the Metropolitan Toronto area extends from Ajax to the east, to Vaughan to the north and Oakville to the west. The Kitchener/Waterloo area includes Cambridge, Guelph and Woodstock.

Table 1

Location, Size, and Product Line of Responding Firms

	Establishments		Employees	
	Number	Per Cent of Total	Number	Per Cent of Total
Location:				
Metropolitan Toronto Area	48	62.3	3,581	28.5
Kitchener/Waterloo Area	9	11.7	1,803	14.3
Rest of Ontario (except Ottawa)	20	26.0	7,182	57.2
Employment Size:				
Under 100 Employees	53	68.9	1,634	13.0
100 to 499 Employees	20	25.9	4,224	33.6
500 Employees or more	4	5.1	6,708	53.3
Product Line*:				
Telephone and Telecommunications Equipment	28	36.4	8,732	69.5
Communications Equipment Other Than Telephone	34	44.2	8,143	64.8
Scientific Engineering and Medical Equipment	26	33.8	4,934	39.3
Computing and Related Equipment	38	49.4	7,271	57.9
Electronic Components	45	58.4	10,470	83.3
TOTAL	77	100.0	12,566	100.0

* Will exceed the totals given because of multiple responses

As mentioned previously, this survey concentrated on firms involved in the manufacture of five product lines. The survey results confirmed that there was considerable diversification among the products manufactured by any one firm. Two-thirds of the firms, especially the larger ones, were involved in the manufacture of more than one product line.

The manufacture of electronic components was the most significant activity of the high-technology electronics industry, as defined in this survey; 58 per cent of the firms, representing 83 per cent of the total reported employment, indicated that they manufacture electronic components. Production of computing equipment was the next most significant activity for many firms (49 per cent), but the employment represented by these firms was less significant than that of firms manufacturing either telephone and telecommunications (70 per cent) or other communications equipment (65 per cent). The manufacture of scientific equipment was the least significant activity; only one-third of the firms, with a comparatively smaller share of reported employment, were involved with this product.line.

Differences in the extent of involvement in certain product lines emerged among the various establishments according to firm size and location. Small firms (fewer than 100 employees) focused more on the manufacture of electronic components and computing equipment as compared to other product lines, while medium-sized firms (100 to 499 employees) were more often involved in the manufacture of electronic components and communications equipment other than telephone. All of the large firms (over 500 employees) produced electronic components, and three-fourths of these also produced telephone and telecommunications equipment. (See Appendix A, Tables I & II).

1.3 Historical Employment Growth: 1975-1981

Since 1975, employment has grown more rapidly for the smallest firms, those located in the Metropolitan Toronto area, and those producing communications equipment other than telecommunications.

The respondents as a whole reported an increase in total employment of nearly 11 per cent between 1975 and 1981, as shown in Table 2. Employment in small- and medium-sized firms increased at a significantly higher rate, 47 per cent and 41 per cent, respectively. The four firms employing 500 or more employees, on the other hand, showed a negative growth rate over this period of time.

Employment in the responding Metropolitan Toronto firms, many of which were small, experienced the largest growth (56 per cent) between 1975 and 1981. In the Kitchener/Waterloo area, there was an increase of 33 per cent. Firms in the rest of Ontario (outside of Ottawa) experienced a negative growth of 6 per cent in total employment over the same time period.

Employment for firms manufacturing communications equipment, other than telecommunications, and computing equipment experienced the fastest employment growth since 1975, increasing by 17 per cent and 15 per cent, respectively. However, much more modest growth was shown for firms manufacturing telecommunications (4 per cent) and electronic equipment (8 per cent). Employment actually declined by 6 per cent for firms manufacturing scientific equipment.

Table 2

Employment Growth by Employee Size, Location, and Product Line 1975-1981

	No. of Establishments*	Total No. Employed 1975	Total No. Employed 1981	Per Cent Change 1975-81
Location:				
Metropolitan Toronto Area	46	2,174	3,391	+ 56.0
Kitchener/Waterloo Area	8	1,300	1,723	+ 32.5
Rest of Ontario (except Ottawa)	17	7,406	6,945	- 6.2
Employment Size:				
Under 100 Employees	49	1,037	1,522	+ 46.8
100 to 499 Employees	18	2,721	3,829	+ 40.7
500 Employees or more	4	7,122	6,708	- 5.8
Product Line:**				
Telephone and Telecommunications Equipment	24	8,128	8,460	+ 4.1
Communications Equipment Other Than Telephone	31	6,711	7,834	+ 16.7
Scientific Engineering and Medical Equipment	22	4,905	4,611	- 6.0
Computing and Related Equipment	37	6,311	7,262	+ 15.0
Electronic Components	41	9,287	9,987	+ 7.5
TOTAL	71	10,880	12,059	+ 10.8

* Only 71 of the 77 firms reported historical employment data.

** Note multiple response.

1.4 Research and Development

The extent of research and development, defined as a per cent of the firm's total sales revenue, varied among the responding establishments. Almost one-third (29 per cent) reported no research and development activity over the past five years. Among those that did, the majority reported spending less than 10 per cent of their total sales revenue on research and development. Smaller firms appeared to spend a greater proportion of their total sales revenue on research and development than either the medium or large firms. (See Appendix A, Table III).

It is also noteworthy that employment growth of the responding firms was positively correlated with the proportion of the total sales revenue spent on research and development. Those firms with no research and development expenditure between 1975 and 1981 experienced a negative employment growth. Those firms that spent between 1 and 5 per cent experienced a growth in employment of almost 4 per cent, while those that spent over 25 per cent on research and development experienced an employment growth of 14 per cent. Firms that spent between 6 and 25 per cent on research and development recorded the largest employment growth - 20 per cent.

II. OCCUPATIONAL CHARACTERISTICS

By cross-classifying the survey data, this chapter provides information about occupational distribution and skill utilization in the industry and notes variations according to geographic location, employee size and product groups, and level of investment in research and development.

2.1 Occupational Definitions

The ten professional and technical job categories selected for the study are believed to be the most prevalent in the high-technology electronics industry, and are grouped in the following major occupational categories (for definitions, see Appendix C):

Engineers	:	includes electrical and electronic, mechanical and chemical engineers;
Scientists	:	includes chemists and physicists
Technologists	:	includes electronic engineering and mechanical engineering technologists; and
Technicians	:	includes electronic engineering; mechanical engineering; and electro-mechanical engineering drafting technicians.

Reported employment in the professional and technical job categories in 1981 totalled 1,990. In addition, the study covered the production worker job category with 6,836 workers reported as employed. The difference in reported employment between the total and the above-mentioned two major groups represents "other" types of occupations.

2.2 Occupational Employment Patterns

The number of people employed in the professional and technical categories accounted for about 16 per cent of the total reported employment in the industry. The engineer and technician job categories each accounted for a little over 5 per cent of the total industry employment, while the technologist category accounted for just under 5 per cent. The number of workers employed in the production category accounted for 54 per cent of total employment. The remaining 30 per cent of the industry's workforce were assumed to be employed in administrative and managerial, sales, clerical and other related categories. These employment patterns, however, varied among the responding firms, depending upon location, size of firm, and product line as shown in Table 3.

Production workers represented the largest proportion of the reported employment in the Kitchener/Waterloo area (71 per cent) but the lowest in the rest of the Province, except Ottawa (47 per cent). By the same token, professional and technical and "other" staff represented the smallest group of workers in the Kitchener/ Waterloo area but largest elsewhere in Ontario. Interestingly, the occupational employment pattern for Metropolitan Toronto area firms was similar to the overall pattern.

As a proportion of total employment, the professional and technical staff accounted for a greater share in smaller firms than they do in the medium or larger firms. For example, in the smaller firms, engineers, scientists, technologists and technicians together accounted for 24 per cent of total employment, whereas in the medium- and large-sized firms, they accounted for only 11 per cent and 17 per cent, respectively.

Table 3

Per Cent Distribution of Employment by Location, Employment Size, and Product Line

Occupational Group	Total	Location			Employment Size			Product Line				
		Metropolitan Toronto Area	Kitchener/ Waterloo Area	Rest of Ontario, ex. Ottawa	Under 100	100-499	500 or more	Teleph. and Telecomm.	Other Comm.	Sc. Equip.	Comp. Equip.	Electronic Components
Engineers	5.4	5.4	3.4	5.8	8.6	4.0	5.4	5.6	6.4	7.4	6.6	4.9
Scientists	0.2	0.3	0	0.1	0.6	0.2	0.1	0.1	0.1	0.3	0.1	0.1
Technologists	4.8	4.0	2.5	5.8	6.1	2.8	5.6	5.4	4.9	5.1	4.9	4.8
Technicians	5.5	5.6	3.2	6.1	8.7	3.4	6.1	6.1	7.0	8.5	7.4	5.1
Total Professional and Technical	15.8	15.4	9.1	17.8	23.9	10.6	17.2	17.3	18.5	21.3	19.0	14.9
Production	54.4	60.4	70.6	47.3	53.7	63.9	48.6	48.7	50.1	41.0	48.9	54.5
Other*	29.8	24.2	20.3	34.9	22.4	25.5	34.2	34.0	31.4	37.7	32.1	30.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Job categories not covered by the survey; would include sales, clerical, etc.

Noteworthy for the medium-sized firms is not only the fact that they had the smallest proportion of professional and technical staff (11 per cent) but also that they had the largest proportion of production workers (64 per cent). In contrast, the large firms had the smallest proportion of production workers and a larger proportion of professional and technical workers. Large firms also had the highest proportion of "other" types of workers (34 per cent). In terms of actual employment levels, the large firms played a dominant role in the professional and technical workforce studied: the four large firms employed 1.4 times the number employed by the 73 small- and medium-sized firms. (See Appendix A, Tabie IV).

By product line, firms manufacturing scientific equipment had the highest proportions of professional and technical as well as "other" staff, but the lowest proportion of production workers. Manufacturers of electronic equipment, on the other hand, had the reverse pattern.

2.3 Skill Utilization

As shown in Table 4, in terms of the professional and technical job categories, electrical and electronic disciplines predominate: 80 per cent of the firms employed electrical/electronic engineers; 70 per cent - electronic engineering technicians, and 68 per cent - electronic engineering technologists. Mechanical engineering disciplines were utilized less frequently, and very few firms reported employing chemists or physicists. Although all survey firms reported manufacturing activities, not all firms reported employing production workers. Nevertheless, that appeared to be the most predominant job category with 94 per cent of the firms employing production workers.

The frequent use of electrical and electronic engineers made this the largest employment category among the professional and technical occupations, with the electronic engineering technologists category second, and the electronic engineering technicians category third. Combined, workers in these three categories accounted for better than 4 out of every 5 professional and technical employees covered by this study.

Table 4

Occupational Distribution in the Responding Firms

Job Categories	Firms Employing Each Category		Reported Employment	
	No.	Per Cent	No.	Per Cent
Electrical and Electronic Engineers	61	79.2	582	4.6
Mechanical Engineers	26	33.8	79	0.6
Chemical Engineers	8	10.4	12	*
Chemists	4	5.2	11	*
Physicists	5	6.5	10	*
Electronic Engineering Technologists	52	67.5	559	4.4
Mechanical Engineering Technologists	19	24.7	42	*
Electronic Engineering Technicians	54	70.1	490	3.9
Mechanical Engineering Technicians	12	15.6	101	0.8
Electro-Mechanical Engineering Drafting Technicians	35	45.5	104	0.8
Production Workers	72	93.5	6,836	54.4
All Other**	N/A	N/A	3,740	29.7
TOTAL	xxx	-	12,566	100.0

* Represents less than 0.5 per cent.

** All other category represents the difference between total and professional and technical employment reported.

2.4 Employee Time Spent on Software Engineering

The 77 responding firms reported that a total of 550 employees, or 5 per cent of their total reported workforce, were working specifically in the area of software engineering. (See Appendix A, Table VI). For purposes of this study, software engineering was defined as the designing, developing or modifying of software programmes/packages in binary machine codes and/or assembly languages.

The number of employees reported to be involved in this endeavour was not exclusively restricted to the ten professional and technical job categories. However, involvement in this area was evident to some degree in all cases, with the electrical and electronic and mechanical engineers, physicists, and electronic engineering technologists devoting the most time to software engineering. For example, 58 per cent of the firms reported that their electrical and electronic engineers were involved in producing software; in nearly half of these firms, engineers spent more than 25 per cent of their time in this area. Similarly, as shown in Table 5, 52 per cent of firms reported their electronic engineering technologists to be involved in software development, though in most firms these workers spent less than 25 per cent of their time in this area.

2.5 Occupational Characteristics of Firms Involved in Research and Development

Of all the employees in the responding firms, 5 per cent were reported to be working in research and development. As might be expected, the number of employees engaged in research and development (as well as software engineering and all the technical and professional staff) increased in proportion to the amount the firm spent on research and development. In contrast, the proportion of production workers was greatest in companies with no research and development expenditures, and least in firms spending more than 25 per cent of their total sales revenue on research and development. (See Appendix A, Table VI).

Table 5

Employee Time Spent on Software Engineering
by Job Category

Job Category	Total No. of Firms Reporting Empl. in Job Cat.	Per Cent of Firms Reporting Employee Time Spent on Software Engineering				
		None	1-25%	26% or more	Not Stated	Total
Electrical and Electronic Engineers	61	36.1	32.8	24.6	6.5	100.0
Chemical Engineers	8	25.0	50.0	12.5	12.5	100.0
Mechanical Engineers	26	57.7	23.1	3.8	15.4	100.0
Chemists	4	50.0	25.0	-	25.0	100.0
Physicists	5	-	80.0	-	20.0	100.0
Electronic Engineering Technologists	52	36.5	36.5	15.4	11.6	100.0
Mechanical Engineering Technologists	19	73.7	15.8	-	10.5	100.0
Electronic Engineering Technicians	54	66.7	14.8	5.5	13.0	100.0
Mechanical Engineering Technicians	12	58.3	8.3	-	33.4	100.0
Electro-Mechanical Engineering Drafting Technicians	35	82.8	5.7	2.9	8.6	100.0

III. QUALIFICATIONS AND HIRING OF PROFESSIONALS AND TECHNICAL STAFF

This chapter summarizes employer responses about minimum education and experience requirements, sources of new hires and hiring difficulties, as well as the types of training they provided for their professional and technical work forces.

3.1 Minimum Educational and Related Experience Requirements

The minimum educational and related experience requirements varied for each occupational group, though many employers surveyed did not respond to this question.

Most employers cited the following minimum requirements for each of the occupational groups:

1) An electrical and electronic engineer, a chemical engineer, a mechanical engineer, and a physicist should have a four-year BSc/BA degree from a university and two to three years' experience

2) An electronic and mechanical engineering technologist should have a three-year community college certificate and two to three years' experience

3) Electronic, mechanical, and electro-mechanical engineering technicians should have a two-year community college certificate and up to two years' experience.

Up to one-third of the responding employers indicated that they did not require any experience for many of the occupational categories. Only a few employers indicated that they preferred a scientist or an engineer with a post-graduate degree. (See Appendix A, Table VII).

3.2 Employer Training Programmes

The most common type of training provided by the responding companies was on-the-job training, followed by courses offered by colleges or universities and courses offered by professional associations. Most companies appeared to provide several types of training for most job categories (See Table 6). Electrical and electronic engineers and electronic engineering technicians and technologists seemed to receive more overall training than the other job categories.

On-the-job training ranged in length from an average of 50 days to approximately 85 days, depending on the job category; college/university courses ranged from an average of 15 days to 41 days; and courses offered by professional associations ranged from an average of 3½ days to 9 days. However, because many companies did not indicate the duration of their training, these are approximate figures only.

Table 6

Type of Training* Provided for Each Job Category

Job Category	Total No. of Firms	On-the-Job Training	Courses Offered by Colleges or Universities	Courses Offered by Prof. Assoc. Connected with this Category	Other Types of Training
		%	%	%	%
Electrical and Electronic Engineers	61	72.1	23.0	19.7	6.6
Mechanical Engineers	26	53.8	23.1	23.1	3.8
Chemical Engineers	8	50.0	25.0	25.0	12.5
Chemists	4	50.0	0	0	25.0
Physicists	5	40.0	20.0	40.0	0
Electronic Engineering Technologists	52	75.0	23.1	11.5	5.8
Mechanical Engineering Technologists	19	63.2	10.5	10.5	5.3
Electronic Engineering Technicians	54	85.2	16.7	11.1	5.6
Mechanical Engineering Technicians	12	66.7	16.7	8.3	8.3
Electro-Mechanical Engineering Drafting Technicians	35	65.7	17.1	11.4	2.9

* some companies offered more than one type of training.

3.3 Sources of Supply of New Hires

The responding firms reported that during 1980 they hired 512 professional and/or technical staff members from outside their firms. Almost one-half of the employers had filled vacancies in this manner, while the others either filled their vacancies internally or had none. Based on the "outside" hiring volume, recruitment had been brisk for electrical and electronic engineers and electronic engineering technicians.

As reflected in Table 7, almost half (46 per cent) of the newly hired came from other employers, approximately 32 per cent from community colleges, 15 per cent from Canadian Universities, and relatively few (6 per cent) either from outside Canada or from some other unspecified source.

While the majority (55 per cent) of engineers were recruited from other employers, a significant proportion (37 per cent) were hired directly from Canadian universities. In the case of technicians and technologists, more than 50 per cent came directly from community colleges, while approximately 40 per cent were recruited from other employers.

3.4 Recent Hiring Experience

Establishments hiring for specific job categories in the past 12 months reported varying levels of difficulty in filling vacant positions for the different professional and technical occupations, as shown in Table 8. Vacancies for electrical and electronic engineers and physicists were the most difficult to fill.

Two-thirds of the firms attempting to hire electrical and electronic engineers encountered difficulties; the major reason given was that applicants lacked appropriate experience. Generally, hiring difficulties were reported more frequently by firms outside the Metropolitan Toronto area and by the larger firms. Physicists were employed relatively infrequently, but all four smaller firms,

Table 7

Sources of Supply for New Hires by Occupational Group

Source of Supply	Total New Hires[1]		Engineers		Technicians		Technologists	
	No.	%	No.	%	No.	%	No.	%
Other Employers	238	46.4	116	54.7	54	38.0	65	41.4
Community Colleges	163	31.8	1	*	76	53.5	86	.6
Canadian Universities	79	15.4	78	36.7	1	.7	-	-
From Outside Canada	18	3.5	12	5.6	3	2.1	2	1.2
Other	14	2.8	2	.9	8	5.6	4	2.5
TOTAL	512	100.0	212	100.0	142	100.0	157	100.0

[1] includes Scientists.

* Less than 0.5 per cent.

Table 8

Hiring Difficulties by Job Category

Job Category	No. of Firms Employing	Firms Reporting New Hires During 1980		
		No.	% of Employing Firms	% of Firms with Hiring Difficulties
Electrical and Electronic Engineers	61	42	68.9	64.2
Chemical Engineers	8	4	50.0	25.0
Mechanical Engineers	26	15	57.7	40.0
Chemists	4	2	50.0	-
Physicists	5	4	80.0	100.0
Electronic Engineering Technologists	52	40	76.9	45.0
Mechanical Engineering Technologists	19	10	52.6	30.0
Electronic Engineering Technicians	54	39	72.2	30.8
Mechanical Engineering Technicians	12	7	58.3	-
Electro-Mechanical Engineering Drafting Technicians	35	24	68.6	41.7
Production Workers	72	58	80.6	25.9

located in the Metropolitan Toronto or the Kitchener/Waterloo areas, who tried to hire physicists, encountered difficulties - again primarily because applicants lacked appropriate experience.

Although less difficulty was encountered in hiring technologists and technicians, in those cases where difficulty was reported, lack of appropriate experience was also given as the main reason. Between 40 and 45 per cent of all firms experienced difficulties in hiring electronic engineering technologists, mechanical engineers and electro-mechanical engineering drafting technicians. For the remaining job categories, 30 per cent or less of the firms reported hiring problems. It is noteworthy that 26 per cent of the firms also reported problems in hiring production workers.

In general, small firms did not seem to experience the same level of hiring difficulties as did medium and large firms. Although more Toronto firms hired professional and technical staff than firms in other areas of the province over the past year, proportionately fewer experienced hiring difficulties.

3.5 Perceived Reasons for Hiring Difficulties - A Recap

Employers appeared prone to cite several reasons for hiring difficulties, but in nearly all instances (91 per cent), they stated that applicants lacked appropriate experience. In fact, this reason was given for all of the job categories, including production workers. The second most often cited reason (70 per cent) for hiring difficulties was the lack of applicants with appropriate education or training, while the third (46 per cent) was a general lack of applicants.

When asked to indicate the main reason, the majority of employers still maintained that they experienced hiring difficulties because of the lack of applicants with appropriate experience. The lack

of applicants with appropriate education or training was cited considerably less frequently. (A fairly significant number of employers hiring electrical and electronic engineers, however, still felt that applicants lacked appropriate education and training). It is also important to note that some firms simply had no applicants for specific job categories, especially for mechanical engineers and mechanical engineering technologists. Only in one case was the firm location mentioned as a drawback. (See Appendix A, Table IX).

Table 9

Reasons for Hiring Difficulties

Reasons for Difficulty	Per Cent of Responses	
	All Responses	Main Reason Only
Lack of Applicants with Appropriate Experience	90.6	52.1
Lack of Appropriate Education or Training	69.8	17.7
Lack of Applicants	45.8	16.7
Location	5.2	1.0
Other and Not Stated	5.2	12.5
TOTAL	...a	100.0

...a will exceed 100.0 per cent because of multiple responses

3.6 Problems in Recruiting Professionals in the 1980's

The responding firms envisaged continuing problems in recruiting professional and technical staff in the 1980's. In particular, continuing shortages for electrical and electronic engineers at senior levels were anticipated by nearly all firms. Also, firms expected that they would need engineers trained in both hardware and software engineering, skills not generally available. Similarly, engineers specializing in various fields, such as LSI, digital design, telephony and integrated circuit componentry were difficult to find.

Continuing problems were foreseen for recruiting experienced electronic technologists and technicians. New graduates, frequently lacking experience in specialized areas, could require up to two years of on-the-job training. A need was also anticipated for electronic technologists with mechanical aptitudes and a knowledge of computer programming, i.e., both hardware and software skills. The demand for electronic technologists and technicians in the United States which attracts many Canadian graduates was seen to lead to stiffer competition, higher salaries and increased recruitment problems in Canada.

IV. EMPLOYMENT OUTLOOK TO 1985

This chapter examines future manpower requirements in the high-technology electronics industry, based on the responding employers' "best estimate" projections for employment to 1985 for the professional, technical and production job categories.

The responding firms based the "best estimate" projections to a large extent on their current business growth. Some of the important factors mentioned in making projections were the following:

- Present sales patterns;
- Growth in current customer-base;
- Enlargement of market-base to Europe and the United States;
- Development of new products;
- Increased research and design work leading to expansion of products, sales and employment;
- Increased demand for electronic products and services in Canada;
- Automation of industrial processes which will affect demand for certain kinds of staff;
- Projected increase in investment development and manufacturing.

4.1 Projected Employment Growth

The responding employers expected that in 1985 their professional and technical employment would be almost 50 per cent higher than it was at the time of the survey. They also expected that their production workforce would expand by 38 per cent over the same time period.

Table 10

Projected Employment by Major Job Category

Job Category	No. Employed 1981	No. Employed 1985	Increase No.	% Change 1981 - 1985
Engineers	620	928	308	49.7
Scientists	21	29	8	38.1
Technologists	574	878	304	53.0
Technicians	669	982	313	46.8
Sub Total: Professional & Technical	1,884	2,817	933	49.5
Production Workers	6,113	8,448	2,335	38.2
TOTAL	7,997	11,265	3,268	40.9

According to these employer estimates, the engineering, technologist and technician categories would each expand by about 300 employees; for every additional professional and technical worker, 2.5 new production jobs would be created in the industry.

4.2 Employment Growth by Size of Firm, Location, and Product Line

Smaller firms, particularly those with fewer than 100 employees, projected that their employment needs in the professional and technical occupational groups would increase at a substantially greater rate than the larger firms. Table 11 indicates that small firms expected a 132 per cent increase in their professional and technical staff by 1985, compared to a 93 per cent increase in medium-sized firms and a 10 per cent increase in the large firms. These growth rates mean that in actual numbers employment in the large firms will only increase by 100 over the projection period, while employment in the small firms will expand by almost 500.

Table 11

Growth Rates and New Jobs by Employee Size, Location, and Product Line, 1981 - 1985

	Professional/Technical Category				Production Workers			
	Employment		Increase	Per Cent Change	Employment		Increase	Per Cent Change
	1981	1985	No.	1981 - 1985	1981	1985	No.	1981 - 1985
Location:								
Metropolitan Toronto Area	500	1,036	536	107.2	1,635	2,635	1,000	61.2
Kitchener/Waterloo Area	160	394	234	146.3	1,225	1,812	587	47.9
Rest of Ontario (except Ottawa)	1,224	1,387	163	13.3	3,253	4,001	748	23.0
Employment Size:								
Under 100 Employees	362	839	477	131.8	737	1,431	694	94.2
100 to 499 Employees	374	721	347	92.8	2,115	3,376	1,261	59.6
Over 500 Employees	1,148	1,257	109	9.5	3,261	3,641	380	13.2
Product Line*:								
Telephone and Telecommunications Equipment	1,467	2,043	576	39.3	3,758	5,066	1,308	34.8
Communications Equipment Other Than Telephone	1,420	2,001	581	40.9	3,447	4,707	1,260	36.6
Scientific Engineering and Medical Equipment	1,021	1,256	235	23.0	1,747	2,341	594	34.0
Computing and Related Equipment	1,300	1,814	514	39.5	2,927	3,873	946	32.3
Electronic Components	1,526	2,091	565	37.0	5,338	7,074	1,736	32.5
TOTAL	1,884	2,817	933	49.5	6,113	8,448	2,335	38.2

* Will exceed the totals given because of multiple responses.

For production workers, a 94 per cent increase by 1985 was predicted by the smaller firms, compared to a 6 per cent increase by the medium-sized firms and a 13 per cent increase by the large firms. In actual numbers, therefore, employment in small firms can be expected to increase by approximately 700 by 1985, in medium-sized firms by nearly 1,300, but in the large firms by only 400.

Responding firms in the various geographical regions of Ontario projected markedly different rates of growth to 1985. Metro Toronto firms estimated the highest rate of growth (72 per cent) for all occupational groups; Kitchener/Waterloo firms projected a 59 per cent growth rate, and firms from the rest of Ontario (except Ottawa) projected a 20 per cent rate of growth. Interestingly, the professional and technical occupational groups were projected to have the greatest overall percentage increase in the Kitchener/Waterloo area (146 per cent), though the numerical increase was expected to be less than in Toronto.

4.3 Projected Growth for Professional and Technical Job Categories

The fastest employment growth for the professional and technical job categories was expected for the relatively smaller occupations such as electro-mechanical engineering drafting technicians (84 per cent) and mechanical engineering technicians (73 per cent). The largest numerical growth, however, was projected for the more popular electrical and electronic engineering disciplines, namely engineers, technologists and technicians, as shown in Table 12.

Table 12

Projected Occupational Employment, 1981 - 1985

Job Category	No. Employed 1981	No. Employed 1985	Increase No.	Per Cent Change 1981 - 1985
Electrical and Electronic Engineers	534	815	281	52.6
Mechanical Engineers	75	97	22	29.3
Chemical Engineers	11	16	5	45.5
Chemists	11	15	4	36.4
Physicists	10	14	4	40.0
Electronic Engineering Technologists	534	809	275	51.5
Mechanical Engineering Technologists	40	69	29	72.5
Electronic Engineering Technicians	482	700	218	45.2
Mechanical Engineering Technicians	93	109	16	17.2
Electro-Mechanical Engineering Drafting Technicians	94	173	79	84.0
TOTAL	1,884	2,817	933	49.5

4.4 Projected Change in Occupational Composition

As a result of the expected varying rates of employment growth for the different job categories, slight changes in the occupational composition in 1985 are likely. As Table 13 shows, the selected professional and technical occupations will account for 25 per cent of the studied employment compared to the current 23 per cent, while the proportion of employment in production can be expected to decline from the current 76 to 75 per cent.

It should be noted that despite the slight proportional decrease of production workers as a per cent of studied employment, the majority of firms still felt that production workers will compose 50 per cent or more of their total employment in 1985.

Table 13

Occupational Distribution, 1981 and 1985

Job Category	Per Cent Distribution		Change
	1981 %	1985 %	
Engineers	7.8	8.2	+0.4
Scientists	0.3	0.3	0
Technologists	7.2	7.8	+0.6
Technicians	8.4	8.7	+0.3
Sub Total: Professional & Technical	23.4	25.0	+1.6
Production Workers	76.4	74.9	-1.5
TOTAL	100.0	100.0	xxx

V. SUMMARY OF MAJOR FINDINGS

This chapter summarizes the major findings as they relate to the objectives of this study and the manpower requirements to 1985 for the selected job categories. Again, readers are cautioned against generalizing on the basis of the statistics presented in this report: The survey should be regarded as an assessment of the information provided by the 77 responding firms, all of which are located outside the Ottawa area.

5.1 Industry Characteristics

As defined in this survey, the majority of the firms in the high-technology electronics industry were small, were located in the Metropolitan Toronto area, and were involved in the manufacture of more than one major product line. In terms of total employment, however, the majority of the industry's workers are employed by large firms and are working outside either the Metropolitan Toronto or the Kitchener/ Waterloo areas. Because of the multiple product lines manufactured, employment patterns according to manufacturing activity are less clear, but it appears that the majority of the workers are employed in firms engaged in electronic components manufacturing while the least number are employed in firms manufacturing scientific, engineering and medical equipment.

Since 1975, employment has grown most quickly in the small firms, those located in the Metropolitan Toronto area, and in firms manufacturing communications equipment other than telephone. The past growth trend for all the responding firms, however, is dampened by the negative employment growth for the largest responding firms which are located outside the two major urban centres studied. It should also be noted that firms spending between 6 and 25 per cent of their sales revenue on research and development recorded the fastest employment growth.

5.2 Occupational Characteristics

Sixteen per cent of total employment in the responding high-technology firms were employed in the ten professional and technical job categories included in this study. Among these, the electrical and electronic disciplines were utilized most often: 80 per cent of the firms employed these engineers, 70 per cent employed technologists, and 60 per cent employed technicians. Many of the firms also reported that their professional and technical workers were spending up to 25 per cent of their time on software engineering.

The reported professional and technical employment, as a proportion of total employment, varied substantially according to firm size, location, product line, and the level of research and development expenditures. For example, in the small firms nearly 25 per cent of all employees were found in the professional and technical job categories compared to only 11 per cent in the medium-sized firms; in the Kitchener/Waterloo area, this proportion was lowest, but elsewhere in Ontario, it was the highest. By product line, the highest proportion of professional and technical employment was reported by scientific equipment manufacturing firms and the lowest by the electronic component manufacturing firms. Finally, the higher the research and development level over the past five years, the higher the proportion of the professional and technical staff.

Production workers constituted about 54 per cent of the total employment in the responding firms. The difference between the reported professional and technical staff and production workers, and total employment is believed to represent employees engaged in other activities such as clerical, sales, etc. This difference, averaging about 30 per cent for all firms, was heavily influenced by the large firms.

5.3 Projected Employment Growth

A substantial employment growth to 1985 was projected for all of the 11 occupational groups under study: professional and technical employment was expected to expand by 50 per cent and production employment by 38 per cent, according to the responding employers' "best estimate" projections. The technologists category was projected to have the fastest rate of growth (53 per cent). Among the professional and technical occupations, however, the electrical and electronic disciplines were expected to offer the greatest number of new jobs. With the expected growth rates, the proportion of professional and technical workers relative to production workers should increase slightly by 1985.

In view of historical growth trends, it is not surprising that smaller firms projected that their employment needs would increase at a substantially faster rate to 1985 than other sized firms. For example, the small firms projected a 132 per cent increase of professional and technical staff, compared to a 92 per cent increase in medium-sized firms and only a 10 per cent increase in large establishments. Though the Kitchener/Waterloo area is projected to have the greatest growth for professional and technical workers, if employer predictions prove accurate, most of the employment growth should materialize in the Metropolitan Toronto area.

5.4 Sources of Supply and Training

In general, close to half of the newly hired employees in 1980 came from other employers, approximately one-third came from community colleges, and 15 per cent came from Canadian universities. While the majority of engineers in 1980 were recruited from other employers, over one-third were hired directly from Canadian universities. Over half of the technicians and technologists were hired directly from community colleges.

Despite the fact that a high proportion of newly hired personnel came from other employers, most firms also provided extensive on-the-job training. For example, in the case of the electrical and electronic engineers, technologists and technicians, better than 70 per cent of the firms provided on-the-job training. And, according to those respondents that indicated the duration of training, some also provided for substantial training courses given by universities, colleges and professional associations.

5.5 Hiring Difficulties

Electrical and electronic engineers and physicists appear to be the most difficult positions to fill. Although the employers cited several reasons for this, the main reason given for most job categories was a lack of applicants with appropriate experience.

The responding firms envisaged continuing problems in recruiting professional and technical staff in the 1980's. In particular, continuing shortages for electronic and electrical engineers at senior levels were anticipated by nearly all firms. Also, many firms expected that they would need engineers trained in both hardware and software engineering, as well as in certain specialized areas, which are not generally available in Canada.

Continuing problems were also foreseen in recruiting electronic technologists and technicians with both sufficient experience and mechanical aptitudes and knowledge of computer programming. The demand for electronic technologists and technicians in the United States will probably continue to attract Canadian graduates leading to stiffer competition, higher salaries and general recruitment problems in Canada.

APPENDIX "A"

Statistical Tables

APPENDIX "A"

Table I

Number of Responding Firms by Employee Size, Location and Product Line

	Total	Location			Employment Size			Product Line*				
		Metro Toronto	Kitch/ Waterloo	Rest of Ont	Under 100 Employ.	100-499 Employ.	500 & Over Employ.	Tele/ Comun. Equip.	Comun. Equip./ Trans.	Scient. Eng./ Medic	Comp- uting	Electr. Equip.
Location:												
Metropolitan Toronto Area	48 62.3%	48 100.0%	0 -	0 -	37 69.8%	11 55.0%	0 -	15 53.6%	22 64.7%	16 61.5%	26 68.4%	25 55.6%
Kitchener/Waterloo Area	9 11.7%	0 -	9 100.0%	0 -	5 9.4%	3 15.0%	1 25.0%	3 10.7%	3 8.8%	2 7.7%	2 5.3%	7 15.6%
Rest of Ontario	20 26.0%	0 -	0 -	20 100.0%	11 20.8%	6 30.0%	3 75.0%	10 35.7%	9 26.5%	8 30.8%	10 26.3%	13 28.9%
Employment Size:												
Under 20 Employees	22 28.6%	15 31.3%	0 -	7 35.0%	22 41.5%	0 -	0 -	7 25.0%	8 23.5%	9 34.6%	10 26.3%	7 15.6%
20 to 100 Employees	31 40.3%	22 45.8%	5 55.6%	4 20.0%	31 58.5%	0 -	0 -	8 28.6%	12 35.3%	11 42.3%	17 44.7%	21 46.7%
Over 100 Employees	24 31.2%	11 22.9%	4 44.4%	9 45.0%	0 -	20 100.0%	4 100.0%	13 46.4%	14 41.2%	6 23.1%	11 28.9%	17 37.8%
Product Line:*												
Telephone and Telecommunications Equipment	28 36.4%	15 31.3%	3 33.3%	10 50.0%	15 28.3%	10 50.0%	3 75.0%	28 100.0%	19 55.9%	8 30.8%	16 42.1%	18 40.0%
Communications Equipment Other Than Telephone	34 44.2%	22 45.8%	3 33.3%	9 45.0%	20 37.7%	12 60.0%	2 50.0%	19 67.9%	34 100.0%	14 53.8%	23 60.5%	15 33.3%
Scientific, Engineering and Medical Equipment	26 33.8%	16 33.3%	2 22.2%	8 40.0%	20 37.7%	5 25.0%	1 25.0%	8 28.6%	14 41.2%	26 100.0%	13 34.2%	14 31.1%
Computing and Related Equipment	38 49.4%	26 54.2%	2 22.2%	10 50.0%	27 50.9%	9 45.0%	2 50.0%	16 57.1%	23 67.6%	13 50.0%	38 100.0%	18 40.0%
Electronic Components	45 58.4%	25 52.1%	7 77.8%	13 65.0%	28 52.8%	13 65.0	4 100.0%	18 64.3%	15 44.1%	14 53.8%	18 47.4%	45 100.0%
TOTAL	77 100.0%	48 100.0%	9 100.0%	20 100.0%	53 100.0%	20 100.0%	4 100.0%	28 100.0%	34 100.0%	26 100.0%	38 100.0%	45 100.0%

* Will exceed the totals given because of multiple responses.

APPENDIX "A"

Table II

Number Employed by Employee Size, Location and Product Line

	Total	Location			Employment Size			Product Line*				
		Metro Toronto	Kitch/ Waterloo	Rest of Ont	Under 100 Employ.	100-499 Employ.	500 & Over Employ.	Tele/ Commun. Equip.	Commun. Equip./ Trans.	Scient. Eng./ Medic	Comp- uting	Electr. Equip.
Location:												
Metropolitan Toronto Area	3,581 28.5%	3,581 100.0%	0 -	0 -	1,105 67.6%	2,476 58.6%	0 -	2,191 25.1%	2,282 28.0%	917 18.6%	1,772 24.4%	2,312 22.1%
Kitchener/Waterloo Area	1,803 14.3%	0 -	1,803 100.0%	0 -	291 17.8%	527 12.5%	985 14.7%	419 4.8%	409 5.0%	356 7.2%	136 1.9%	1,416 13.5%
Rest of Ontario	7,182 57.2%	0 -	0 -	7,182 100.0%	238 14.6%	1,221 28.9%	5,723 85.3%	6,122 70.1%	5,452 67.0%	3,661 74.2%	5,363 73.8%	6,742 64.4%
Employment Size:												
Under 20 Employees	172 1.4%	116 3.2%	0 -	56 .8%	172 10.5%	0 -	0 -	46 .5%	52 .6%	78 1.6%	76 1.0%	46 .4%
20 to 100 Employees	1,462 11.6%	989 27.6%	291 16.1%	182 2.5%	1,462 89.5%	0 -	0 -	452 5.2%	597 7.3%	596 12.1%	716 9.8%	1,008 9.6%
Over 100 Employees	10,932 87.0%	2,476 69.1%	1,512 83.9%	6,944 96.7%	0 -	4,224 100.0%	6,708 100.0%	8,234 94.3%	7,494 92.0%	4,260 86.3%	6,479 89.1%	9,416 89.9%
Product Line:*												
Telephone and Telecommunications Equipment	8,732 69.5%	2,191 61.2%	419 23.2%	6,122 85.2%	498 30.5%	2,511 59.4%	5,723 85.3%	8,732 100.0%	7,007 86.0%	4,144 84.0%	6,148 84.6%	7,812 74.6%
Communications Equipment Other Than Telephone	8,143 64.8%	2,282 63.7%	409 22.7%	5,452 75.9%	649 39.7%	2,947 69.8%	4,547 67.8%	7,007 80.2%	8,143 100.0%	4,629 93.8%	6,750 92.8%	6,465 61.7%
Scientific, Engineering and Medical Equipment	4,934 39.3%	917 25.6%	356 19.7%	3,661 51.0%	674 41.2%	1,113 26.3%	3,147 46.9%	4,144 47.5%	4,629 56.8%	4,934 100.0%	4,132 56.8%	4,241 40.5%
Computing and Related Equipment	7,271 57.9%	1,772 49.5%	136 7.5%	5,363 74.7%	792 48.5%	1,932 45.7%	4,547 67.8%	6,148 70.4%	6,750 82.9%	4,132 83.7%	7,271 100.0%	5,859 56.0%
Electronic Components	10,470 83.3%	2,312 64.6%	1,416 78.5%	6,742 93.9%	1,054 64.5%	2,708 64.1%	6,708 100.0%	7,812 89.5%	6,465 79.4%	4,241 86.0%	5,859 80.6%	10,470 100.0%
TOTAL	12,566 100.0%	3,581 100.0%	1,803 100.0%	7,182 100.0%	1,634 100.0%	4,224 100.0%	6,708 100.0%	8,732 100.0%	8,143 100.0%	4,934 100.0%	7,271 100.0%	10,470 100.0%

* Will exceed the totals given because of multiple responses.

APPENDIX "A"

Table III

Per Cent of Total Sales Revenue Spent on Research and Development in Past 5 Years by Number of Firms, Employee Size, Location, and Product Line

Percentage of Total Sales Revenue Spent on R & D in Past 5 Years	Total	Location			Employment Size			Product Line*				
		Metro Toronto	Kitch/ Waterloo	Rest of Ont	Under 100 Employ.	100-499 Employ.	500 & Over Employ.	Tele/ Commun. Equip.	Commun. Equip./ Trans.	Scient. Eng./ Medic	Comp- uting	Electr. Equip.
None	22 28.5%	17 35.4%	2 22.2%	3 15.0%	15 28.3%	6 30.0%	1 25.0%	7 25.0%	10 29.4%	4 15.4%	13 34.2%	13 28.9%
1	5 6.5%	4 8.3%	0 -	1 5.0%	4 7.5%	1 5.0%	0 -	2 7.1%	0 -	1 3.8%	2 5.3%	4 8.9%
2	8 10.4%	5 10.4%	2 22.2%	1 5.0%	5 9.4%	2 10.0%	1 25.0%	3 10.7%	3 8.8%	2 7.7%	2 5.3%	6 13.3%
3	3 3.9%	0 -	1 11.1%	2 10.0%	3 5.6%	0 -	0 -	2 7.1%	0 -	0 -	0 -	2 4.4%
5	9 11.7%	4 8.3%	1 11.1%	4 20.0%	5 9.4%	3 15.0%	1 25.0%	3 10.7%	3 8.8%	4 15.4%	4 10.5	8 17.8%
8	1 1.3%	1 2.1%	0 -	0 -	0 -	1 5.0%	0 -	0 -	0 -	0 -	0 -	1 2.2%
10	7 9.1%	5 10.4%	0 -	2 10.0%	7 13.2%	0 -	0 -	1 3.6%	4 11.8%	4 15.4%	5 13.2%	2 4.4%
12	1 1.3%	1 2.1%	0 -	0 -	1 1.9%	0 -	0 -	1 3.6%	1 2.9%	1 3.8%	1 2.6%	1 2.2%
15	3 3.9%	2 4.2%	0 -	1 5.0%	2 3.8%	1 5.0%	0 -	0 -	1 2.9%	2 7.7%	1 2.6%	2 4.5%
20	1 1.3%	0 -	0 -	1 5.0%	1 1.9%	0 -	0 -	1 3.6%	1 2.9%	0 -	0 -	0 -
25	3 3.9%	1 2.1%	1 11.1%	1 5.0%	3 5.7%	0 -	0 -	1 3.6%	2 5.9%	2 7.7%	1 2.6%	2 4.5%
35	1 1.3%	1 2.1%	0 -	0 -	1 1.9%	0 -	0 -	0 -	0 -	1 3.8%	0 -	0 -
40	1 1.3%	1 2.1%	0 -	0 -	1 1.9%	0 -	0 -	0 -	0 -	1 3.9%	0 -	0 -
50	3 3.9%	3 6.2%	0 -	0 -	3 5.7%	0 -	0 -	0 -	1 3.0%	3 11.5%	2 5.3%	1 2.2%
Don't Know	2 2.6%	0 -	2 22.3%	0 -	0 -	2 10.0%	0 -	1 3.6%	1 3.0%	1 3.9%	1 2.6%	0 -
Not Stated	7 9.1%	3 6.3%	0 -	4 20.0%	2 3.8%	4 20.0%	1 25.0%	6 21.4%	7 20.6%	0 -	6 15.8%	3 6.7%
TOTAL	77 100.0%	48 100.0%	9 100.0%	20 100.0%	53 100.0%	20 100.0%	4 100.0%	28 100.0%	34 100.0%	26 100.0%	38 100.0%	45 100.0%

* Will exceed the totals given because of multiple responses.

APPENDIX "A"

Table IV

Number of Firms Reporting Employment by Job Category, Employee Size, Location, and Product Line

Job Category	Total	Location			Employment Size			Product Line*				
		Metro Toronto	Kitch/ Waterloo	Rest of Ont	Under 100 Employ.	100-499 Employ.	500 & Over Employ.	Tele/ Commun. Equip.	Commun. Equip./ Trans.	Scient. Eng./ Medic	Comp- uting	Electr. Equip.
Electrical and Electronic Engineers	61	40	8	13	40	17	4	19	28	21	29	36
	79.2%	83.3%	88.9%	65.0%	75.5%	85.0%	100.0%	67.9%	82.4%	80.8%	76.3%	80.0%
Chemical Engineers	8	3	0	5	1	5	2	5	7	4	5	5
	10.4%	6.3%	-	25.0%	1.9%	25.0%	50.0%	17.9%	20.6%	15.4%	13.2%	11.1%
Mechanical Engineers	26	15	4	7	13	9	4	12	10	8	9	18
	33.8%	31.3%	44.4%	35.0%	24.5%	45.0%	100.0%	42.9%	29.4%	30.8%	23.7%	40.0%
Chemists	4	2	0	2	1	2	1	2	3	3	2	2
	5.2%	4.2%	-	10.0%	1.9%	10.0%	25.0%	7.1%	8.8%	11.5%	5.3%	4.4%
Physicists	5	3	0	2	2	3	0	0	1	3	0	3
	6.5%	6.3%	-	10.0%	3.8%	15.0%	-	-	2.9%	11.5%	-	6.7%
Electronic Engineering Technologists	52	31	7	14	33	15	4	18	29	20	31	27
	67.5%	64.6%	77.8%	70.0%	62.3%	75.0%	100.0%	64.3	85.3%	76.9%	81.6%	60.0%
Mechanical Engineering Technologists	19	13	1	5	9	8	2	8	10	10	7	10
	24.7%	27.1%	11.1%	25.0%	17.0%	40.0%	50.0%	28.6%	29.4%	38.5%	18.4%	22.2%
Electronic Engineering Technicians	54	38	5	11	35	15	4	18	24	19	28	28
	70.1%	79.2%	55.6%	55.0%	66.0%	75.0%	100.0%	64.3%	70.6%	73.1%	73.7%	62.2%
Mechanical Engineering Technicians	12	7	1	4	5	4	3	4	5	5	7	6
	15.6%	14.6%	11.1%	20.0%	9.4%	20.0%	75.0%	14.3%	14.7%	19.2%	18.4%	13.3%
Electro-Mechanical Engineering Drafting Technicians	35	21	5	9	21	12	2	14	19	16	19	19
	45.5%	43.8%	55.6%	45.0%	39.6%	60.0%	50.0%	50.0%	55.9%	61.5%	50.0%	42.2%
Production Workers	72	45	9	18	48	20	4	25	32	24	37	43
	93.5%	93.8%	100.0%	90.0%	90.6%	100.0%	100.0%	89.3%	94.1%	92.3%	97.4%	95.6%

* Will exceed the totals given for each category because of multiple responses.

APPENDIX "A"

Table V

Number of Employees Reporting Employment in Each Job Category, by Employee Size, Location, and Product Line

Job Category	Total	Location			Employment Size			Product Line*				
		Metro Toronto	Kitch/ Waterloo	Rest of Ont	Under 100 Employ.	100-499 Employ.	500 & Over Employ.	Tele/ Commun. Equip.	Commun. Equip./ Trans.	Scient. Eng./ Medic	Comp- uting	Electr. Equip.
Electrical and Electronic Engineers	582	168	57	357	125	145	312	423	459	322	419	436
	4.6%	4.7%	3.2%	5.0%	7.6%	3.4%	4.7%	4.8%	5.6%	6.5%	4.8%	4.2%
Chemical Engineers	12	3	0	9	1	4	7	10	11	4	10	9
	.1%	.1%	-	.1%	.1%	.1%	.1%	.1%	.1%	.1%	.1%	.1%
Mechanical Engineers	79	24	5	50	15	20	44	58	54	41	52	66
	.6%	.7%	.3%	.7%	.9%	.5%	.7%	.7%	.7%	.8%	.7%	.6%
Chemists	11	6	0	5	3	3	5	8	8	8	8	5
	.1%	.2%	-	.1%	.2%	.1%	.1%	.1%	.1%	.2%	.1%	**
Physicists	10	6	0	4	6	4	0	0	2	8	0	4
	.1%	.2%	-	.1%	.4%	.1%	-	-	**	.2%	-	**
Electronic Engineering Technologists	559	120	43	396	82	116	361	453	377	219	329	475
	4.4%	3.4%	2.4%	5.5%	5.0%	2.7%	5.4%	5.2%	4.6%	4.4%	4.5%	4.5%
Mechanical Engineering Technologists	42	22	2	18	17	12	13	21	24	31	27	25
	.3%	.6%	.1%	.3%	1.0%	.3%	.2%	.2%	.3%	.6%	.4%	.2%
Electronic Engineering Technicians	490	122	38	330	94	84	312	382	405	310	387	395
	3.9%	3.4%	2.1%	4.6%	5.8%	2.0%	4.7%	4.4%	5.0%	6.3%	5.3%	3.8%
Mechanical Engineering Technicians	101	22	2	77	11	13	77	83	87	60	90	84
	.8%	.6%	.1%	1.1%	.7%	.3%	1.1%	1.0%	1.1%	1.2%	1.2%	.8%
Electro-Mechanical Engineering Drafting Technicians	104	58	17	29	37	46	21	72	79	48	63	57
	.8%	1.6%	.9%	.4%	2.3%	1.1%	.3%	.8%	1.0%	1.0%	.9%	.5%
Production Workers	6,836	2,163	1,273	3,400	877	2,698	3,261	4,250	4,082	2,024	3,557	5,703
	54.4%	60.4%	70.6%	47.3%	53.7%	63.9%	48.6%	48.7%	50.1%	41.0%	48.9%	54.5%

* Will exceed the totals given for each category because of multiple responses.

** Per cent less than .05

APPENDIX "A"

Table VI

Employment Characteristics of Establishments with Varying Degrees of Involvement in Research and Development by Extent of Research and Development Function (Proportion of Total Sales Revenue Represented by Research and Development)

	Total	None	1 To 5 Per Cent	6 To 25 Per Cent	More Than 25 Per Cent
Total Establishments	77 100.0%	22 100.0%	25 100.0%	16 100.0%	5 100.0%
Total Employees	12,566 100.0%	2,438 100.0%	6,116 100.0%	721 100.0%	141 100.0%
Employment Characteristics					
Total Production Employees	6,836 54.4%	1,521 62.4%	3,094 50.6%	447 62.0%	36 25.5%
Total Software Engineering Employees	549 4.4%	31 1.3%	369 6.0%	55 7.6%	5 3.5%
Total Research and Development Employees	571 4.5%	12 .5%	294 4.8%	98 13.6%	50 35.5%
Total All Other Technical/ Professional Employees	1,990 15.8%	259 10.6%	972 15.9%	181 25.1%	57 40.4%

APPENDIX "A"

Table VII

Minimum Educational Requirements

Job Category	Total	Completed Grade 12	Completed Grade 13	Completed Trade School	Completed 1-2 Yr. Community College	Completed 3 Yr. Community College	Completed University	Completed BSc/BA 3 Yr.	Completed BSc/BA 4 Yr.	Completed MA/ PHD	Not Specified
Electrical and Electronic Engineers	61	0	1.6	3.2	1.6	8.1	11.4	9.8	42.6	1.6	19.6
Chemical Engineers	8	0	0	0	0	12.5	0	0	50.0	0	37.5
Mechanical Engineers	26	0	0	3.8	0	11.5	3.8	3.8	38.4	3.8	34.6
Chemists	4	0	0	0	25.0	25.0	0	0	0	0	50.0
Physicists	5	0	0	0	0	0	20.0	0	40.0	20.0	20.0
Electronic Engineering Technologists	52	3.8	3.8	9.6	17.3	53.8	0	0	0	1.9	9.6
Mechanical Engineering Technologists	19	0	5.2	5.2	10.5	42.1	0	0	5.2	0	31.5
Electronic Engineering Technicians	54	7.4	1.8	18.5	50.0	7.4	0	0	0	0	14.8
Mechanical Engineering Technicians	12	0	0	8.3	58.3	8.3	0	0	0	0	25.0
Electro-Mechanical Engineering Drafting Technicians	35	8.5	5.7	17.0	31.2	14.2	0	0	0	0	20.0

APPENDIX "A"

Table VIII

Minimum Experience Requirements

Job Category	Total	None	1 Year	2 Years	3 Years	4 Years	5 Years	Not Specified	Not Applicable
Electrical and Electronic Engineers	61	21.3	6.5	16.3	18.0	0	8.1	21.3	8.1
Chemical Engineers	8	25.0	0	0	25.0	0	0	37.5	12.5
Mechanical Engineers	26	26.9	0	0	23.0	0	7.6	11.5	15.3
Chemists	4	0	0	25.0	0	0	0	50.0	25.0
Physicists	5	0	0	20.0	0	20.0	20.0	20.0	20.0
Electronic Engineering Technologists	52	25.0	15.3	23.0	9.3	3.8	0	19.2	3.8
Mechanical Engineering Technologists	19	15.7	0	15.7	21.0	0	0	31.5	15.7
Electronic Engineering Technicians	54	31.5	16.7	20.4	5.5	0	3.7	18.5	3.7
Mechanical Engineering Technicians	12	25.0	16.7	16.7	8.3	0	0	25.0	8.3
Electro-Mechanical Engineering Drafting Technicians	35	11.4	25.9	8.6	5.7	0	5.7	31.5	11.4

APPENDIX "A"

Table IX

Main Reasons for Hiring Difficulties

Job Category	Firms Having Hiring Difficulties No.	Lack of Applicants %	Lack of Applic's with Approp. Exper. %	Lack of Applic's with Approp. Educ. & Training %	Lack of Applicants with Adaptability %	Other or Not Stated %
Electrical and Electronic Engineers	27	14.8	48.1	22.2	3.7	11.1
Chemical Engineers	1	-	100.0	-	-	-
Mechanical Engineers	6	33.3	66.7	-	-	-
Chemists	0	-	-	-	-	-
Physicists	4	25.0	50.0	-	-	25.0
Electronic Engineering Technologists	18	11.1	61.1	16.7	-	11.1
Mechanical Engineering Technologists	3	33.3	33.3	-	-	33.3
Electronic Engineering Technicians	12	16.7	58.3	16.7	-	8.3
Mechanical Engineering Technicians	0	-	-	-	-	-
Electro-Mechanical Engineering Drafting Technicians	10	20.0	50.0	20.0	-	10.0
Production Workers	15	13.3	40.0	26.7	6.7	15.4

APPENDIX "B"

Methodology

The methodology adopted for making projections of manpower requirements was the employer survey approach. The study was conducted in several stages.

First, the Ontario Manpower Commission compiled a list of establishments engaged in manufacturing electronic component assemblies, or final products in Ontario, except in the Ottawa area. 193 such establishments were identified. This was used as the sampling frame.

Second, Canadian Facts was provided with this list, which included the name, address, telephone number and number of employees in each establishment.

Third, Canadian Facts contacted each establishment by telephone in order to qualify the firm for the study, to explain the purpose of the study and to determine the name of the individual in the company most appropriate to provide manpower planning information, and to elicit agreement to complete a questionnaire. A series of call backs were made in order to reach the appropriate company executive. All calls were recorded on the Record of Call form.

Telephone interviews were attempted with the 193 establishments.

117 establishments agreed to co-operate with the survey and to accept the self-completed questionnaire. The interviewing took place during the last week of February, 1981.

Fourth, a structured questionnaire was devised to obtain information on each of the stated objectives (Appendix "E"). The professional and technical job categories selected for study included:

electrical and electronic engineers
electronic engineering technicians
electronic engineering technologists
electro-mechanical engineering drafting technicians
mechanical engineers
mechanical engineering technicians
mechanical engineering technologists
chemical engineers
physicists

Production workers were also included in the study.

The questionnaire, together with an introductory letter, was dispatched by courier to each of the 117 firms agreeing to participate in the survey. A subsequent series of telephone calls was made to establish a date for courier pick-up of the completed questionnaires.

Only 57 of the 117 establishments had completed and returned their questionnaires as of March 26th, despite the many rounds of telephone calls encouraging them to do so. A second mailing of survey materials was sent to all non-respondents (i.e., 60 firms) in early April which resulted in an additional 20 completions.

Fifth, the analysis and report writing stages were undertaken initially by Canadian Facts and subsequently by the Ontario Manpower Commission.

Outlined below is a summary of the outcome of this phase of the research.

Table 1

No. of Initial Establishments

Response	Number	%
Total No. of Initial Establishments	193	
a) Company Not at Listed Number and Could Not be Traced	5	
b) Company Does Not Qualify	27	
c) Duplicate Company	2	
TOTAL POTENTIAL PLACEMENTS	159	100
a) Refusals	19	
b) Qualified Executive Not Available After Multiple Attempts	23	
TOTAL PLACEMENTS	117	74
Computed and Returned	57	
Returned 2nd Mailing	20	
TOTAL	77	48

APPENDIX "C"

About the Job Categories

Report employees in the job category in which they are working, not in a job category for which they may have been trained, if that is different. For example, an employee trained as an engineer but working as a draftsperson should be reported in the draftsperson category. Include all persons in research and development production, management, technical services, sales or other positions which require them to use the indicated level of knowledge in their work.

Working supervisors, i.e., those spending 20 per cent or more of their time at work similar to that performed by workers under their supervision, should be included in the job category which is most closely related to their work duties.

Report as engineers all persons actually engaged in engineering work at a level which requires knowledge of engineering equivalent to that acquired through completion of university with a major in one of the engineering fields. Report as scientists all persons actually engaged in the respective scientific work at a level which requires knowledge of the respective disciplines to that acquired through completion of university with a major in one of the scientific fields.

Technologists and technicians typically perform functions that are primarily related to the following activities:

Technologists	Technicians
Research	Installation
Development	Operation & Maintenance
Design	Quality Control
Testing & Analysis	Production Planning & Analysis
	Testing & Analysis

Technologists usually receive their basic training in a post-secondary school, institute or college, with further specialized on-the-job training to achieve occupational competency. (In Ontario, usually, the three-year technical courses offered by the Community Colleges of Applied Arts and Sciences award graduates with a technologist certificate).

Technicians also receive their basic training in institutes or colleges, but some attain full competency by being trained on-the-job following completion of high school. (In Ontario, usually, the two-year technical courses offered by the Community Colleges of Applied Arts and Sciences award graduates with a technician certificate).

Job Categories Defined:

Electrical Engineer: performs a variety of engineering work in designing, planning and overseeing manufacture, construction, installation, operation and maintenance of electric or electronic components, equipment, systems, facilities, and machinery used in generation, transmission, distribution and utilization of electrical energy for domestic, commercial or industrial consumption.

Electronic Engineer: conducts research and development concerned with design and manufacture of vacuum and gaseous tubes, semi-conductors and other solid-state devices, and electronic equipment, and their application to commercial, industrial, military, scientific and medical equipment, processes and problems.

Chemical Engineer: concerned with research and design and development of manufacturing process in which chemical changes occur; and supervision of the construction, operation and maintenance of chemical plant equipment.

Mechanical Engineer: concerned with applied research, development and design of mechanical equipment and its manufacture; supervision of the operation, maintenance or repair of machines that produce, transmit or consume power or energy and the tools with which machinery and equipment are made, and evaluation of installed plant and process related to machines.

Chemist: concerned with conducting basic research to extend the knowledge of the science of chemistry and with conduction applied research to develop new or improved materials, compounds, and substances for commercial purposes; developing analytical methodology and techniques, and performing quantitative and qualitative analyses and experiments in organic, inorganic and physical chemistry.

Physicist: concerned with conducting theoretical and experimental research to extend the knowledge of the science of physics, and applied research related to the scientific and commercial utilization of heat, light, acoustics, electricity and magnetism, atoms, molecules and nuclei and other physical phenomena.

Electronics Engineering Technologist: performs technological functions in various aspects of electronic engineering, primarily in support of research, development and design. May be concerned with particular phase of electronic engineering technology and be designated accordingly: e.g., circuit designer, development technologist; electronic prototype technologist; aircraft electronics technologists.

Mechanical Engineering Technologist: performs technological functions in various aspects of mechanical engineering, primarily in support of design and development. May be concerned with particular phase of electronic engineering technology and be designated accordingly: e.g., designer, mechanical-engineering equipment; development technologist; mechanical engineering; engineering assistant, mechanical equipment, etc.

Electronic Engineering Technician: performs technical functions in various aspects of electronic engineering primarily in support of installation, operation, maintenance, production and quality control. May be concerned with particular phase of electronic engineering technology and be designated accordingly: e.g., calibration technician; electronic-equipment technician; inspection technician, electronics; test-equipment technician, etc.

Mechanical Engineering Technician: performs technical functions in various aspects of mechanical engineering, primarily in support of installation, operation, maintenance, production and quality control. May be concerned with a particular technical aspect of mechanical engineering and be designated accordingly: e.g., engineering checker; equipment development technician; tool-planning liaison person, etc.

Electro-Mechanical Engineering Drafting Technician: performs drafting and design functions in various aspects of electronic and mechanical engineering, primarily in support of manufacture, assembly, installation, maintenance and quality control of electronic and mechanical equipment. May be concerned with a particular aspect of electronic or mechanical engineering and be designated accordingly: e.g., electronic engineering drafting technician; mechanical engineering drafting technician; etc.

Production Workers and related workers in manufacturing activity include those employees engaged in processing, assembling, storing, inspecting, handling, packaging, maintenance, repair, janitorial and watchmen services and working foremen.

Ontario
Manpower
Commission

APPENDIX "D"

Office of the
Chairman

416/965-

400 University Avenue
Toronto, Ontario
M7A 1T7

Dear

You probably know that many Canadian firms in the high-technology industries are unable to find enough professional, scientific, and technical people to meet their needs. The lack of qualified workers for many key jobs is retarding the growth of these firms and putting them at a severe disadvantage in this internationally competitive industry.

The Ontario Manpower Commission is concerned about this problem and would like to help solve it. The OMC was established in the summer of 1979 to coordinate manpower policy throughout the Ontario government. The Commission has paid special attention to shortages of skilled workers in the province and the adverse consequences they have for the provincial economy.

The first step toward solving this problem in the high-technology industries is to find out how many and what type of skilled workers these firms will need during the next 5 years. Since almost no information is currently available on the number of professional, scientific, and technical workers that are needed in these industries, we have decided to approach the most reliable source: the high-technology firms themselves.

We have retained Canadian Facts, a survey research company, to conduct a province-wide survey of companies that manufacture high-technology equipment. They will send you a questionnaire that asks for detailed information about your present and expected need for workers in specified professional, scientific, and technical occupations. This information is essential to the development and recommendations of appropriate policies to the Ontario Government.

.../2

We can assure you that the information you give to Canadian Facts will remain strictly confidential, and that the OMC will receive this information only after Canadian Facts has removed all reference to your company. When our report is completed we will send a copy to each firm that participated in the survey.

A project such as this one can succeed only if a large number of firms agree to support it. We hope that you will help us by completing the questionnaire that Canadian Facts sends you. In the meantime, if we at the Commission can assist you in any way, please call Dr. Farid Siddiqui, Chief Economist at 965-5797.

Thank you for your cooperation.

Yours very truly,

R.D. Pollock
Chairman

/sea

CANADIAN FACTS
Vancouver Toronto Ottawa Montreal
A division of SR/CF Inc

Canadian Facts
1075 Bay Street, Toronto
Ontario M5S 2X5 (416) 924-5751

Dear Survey Participant:

Re:

Thank you for agreeing to participate in this survey, which we are conducting on behalf of the Ontario Manpower Commission. Once the data are collected and analysed, it is expected that the insights gained as a result of this survey will help to forecast Ontario's manpower needs in the high technology industries.

In this survey, we are concerned with particular job categories within the professional/scientific and technical occupation areas. There is also a section about production workers. Each job category is dealt with on an individual questionnaire. We recognize that not all the job categories will be applicable to your establishment. We have, therefore, prepared a summary appendix which outlines and defines all the job categories for which we are collecting data. After you have completed Section I, "About Your Establisnment", please read through the appendix "About The Job Categories" and check off those occupations which are relevant to your establishment; then fill out only those questionnaires (from Section II to Section XII) which correspond to the occupations you have checked off on the appendix. You may discard any non-applicable sections.

A courier will pick up the completed questionnaire four days after the day of delivery. (EXAMPLE: Ouestionnaires delivered on a Friday will be called for the following Thursday, those delivered on a Monday will be called for on the Friday of that week.) We count on your co-operation to meet these deadlines and ensure the success of this survey.

Should you encounter any difficulties while filling out the questionnaires, please feel free to call me with your query at (416) 924-5751.

Thanking you in advance for your co-operation,

Yours truly,

Barbara Roland

BARBARA ROLAND
STUDY DIRECTOR

RECORD OF CALL
AND
SCREENING QUESTIONNAIRE

4-
5-0
6-1

APPENDIX "E"

ADDRESS ON LABEL CORRECT FOR DELIVERY ☐
ADDRESS ON LABEL INCORRECT FOR DELIVERY ☐

CHANGE TO: _____

_____

POSTAL CODE: _____
7- 8- 9-

Stop Here
Unless Otherwise
Instructed

OUTCOME OF DIAL:	CALL NO. / DATE	1	2	3	4
NOT IN SERVICE/RECORDING		1	1	1	1
NO RING		2	2	2	2
WRONG NUMBER		3	3	3	3
BUSY ... 1		4	4	4	4
... 2		5	5	5	5
... 3		6	6	6	6
NO ANSWER		7	7	7	7

INTRODUCTION: Good Morning/Afternoon. Is this (SPECIFY COMPANY) ? My name is _____ of Canadian Facts. We are an independent survey research company. We are conducting a survey on behalf of The Ontario Manpower Commission and I have been instructed to interview the most senior executive officer at (SPECIFY COMPANY) at (SPECIFY ADDRESS). Could you tell me who that is and connect me to that person?

NAME OF MOST
SENIOR EXECUTIVE
AT THIS LOCATION: Mr. ☐
Ms. ☐ _____ TITLE: _____

RE-INTRODUCE YOURSELF TO RESPONDENT: Good Morning/Afternoon, (NAME OF RESPONDENT). I am _____ from Canadian Facts, an independent market research company. We are conducting a province wide survey for The Ontario Manpower Commission about the future staffing requirements of companies involved in selected areas of manufacturing. Can you tell me whether your company is engaged in the manufacture of any of the following product lines, at your location of (SPECIFY ADDRESS) ? (READ LIST)

	YES	NO
Telephone And Telecommunications Equipment	10-1	☐
Communications Equipment Or Data Transmission Equipment Other Than Telephone Equipment	11-1	☐
Scientific, Engineering, Or Medical Equipment	12-1	☐
Computing And Related Equipment	13-1	☐
Electronic Components	14-1	☐

IF NO TO ALL, END INTERVIEW, THANK RESPONDENT AND RECORD BELOW

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* The Ontario Manpower Commission is studying manpower requirements in high technology industries. The information obtained will be used to help forecast future manpower requirements in the professional, scientific and technical areas. Would you say that you are the executive best able to respond to questions about these areas for your establishment?

YES ..... 1 THIS IS A QUALIFIED RESPONDENT. CONTINUE INTERVIEW.

NO 2

In that case, would you please refer me to the appropriate executive?

NAME: Mr. ☐ Ms. ☐ _____ TITLE: _____

LOCATION: SAME AS ABOVE ☐

DIFFERENT ☐ (SPECIFY): _____

_____

_____

TELEPHONE NUMBER: _____

ATTEMPT INTERVIEW WITH REFERRED EXECUTIVE AS YOUR NEXT CALL. RE-INTRODUCE YOURSELF: Good Morning/Afternoon, (NAME OF RESPONDENT). I am _____ from Canadian Facts, an independent market research company. We are conducting a province wide survey for The Ontario Manpower Commission and (SPECIFY COMPANY) at (SPECIFY ADDRESS FROM LABEL) has been randomly selected for our study. (CONTINUE AT ASTERISK ABOVE.)

We would appreciate your co-operation for our study. Could we deliver to your office a self-complete questionnaire within the next day or two? You could fill it out at your convenience and our courier will pick it up from your office.

I would just like to confirm that the address we have is the correct address for courier delivery. (VERIFY ADDRESS FOR DELIVERY)

Stop Here Unless Otherwise Directed ↓

OUTCOME OF CONTACT — CALL NO.	1	2	3	4
COMPANY REFUSAL TO CONNECT TO MOST SENIOR COMPANY EXECUTIVE	1	1	1	1
REFERRED TO AN EXECUTIVE AT ANOTHER LOCATION (NOTE INF. AND CALL AS NEXT ATTEMPT)	2	2	2	2
QUALIFIED RESPONDENT NOT AVAILABLE	3	3	3	3
APPOINTMENT: DAY _____ TIME: _____	4	4	4	4
REFERRED TO ANOTHER EXECUTIVE AT THIS LOCATION	5	5	5	5
RESPONDENT REFUSED TELEPHONE INTERVIEW	6	6	6	6
COMPANY (AT THIS LOCATION) DOES NOT QUALIFY AS MANUFACTURER	7	7	7	7
RESPONDENT REFUSED MAIL INTERVIEW	8	8	8	8
RESPONDENT AGREED TO MAIL INTERVIEW	9	9	9	9

REASONS FOR REFUSAL: _____

_____

INTERVIEWER'S NAME: _____

EMPLOYEE NUMBER: _____

SECTION 1--ABOUT YOUR ESTABLISHMENT

NOTE: The questions in this section are to be answered for the establishment at the address specified in our covering letter. (I.e. Do not include any operations at other locations.)

1-a) How many full-time permanent employees do you currently have at this location?

Number Of Individuals Currently Employed: _____ (WRITE IN) 15/18

2-a) How many full-time permanent employees were at this location at this time of year in 1975 and 1980?

-b) And how many of the full-time permanent employees were production workers? (NOTE: For purposes of this study, production workers are those employees engaged in processing, assembling, storing, inspecting, handling, packaging, maintenance, repair, janitorial and watchmen services and working foremen.)

	-a) TOTAL NUMBER OF EMPLOYEES	-b) TOTAL NUMBER OF PRODUCTION EMPLOYEES
1975:	_____ 19/22...	_____ 27/30
1980:	_____ 23/26...	_____ 31/34

3. How many full-time permanent employees are currently employed in the area (or department) of research and development (including both professional and support staff)? (NOTE: For purposes of this study, research and development includes the following types of activities:

(a) Pursuit of planned research of new knowledge, whether or not the research has reference to a specific application.

(b) Application of existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.

(c) Application of existing knowledge to problems involved in the improvement of an existing product or process.)

Number Of Individuals Currently Employed In Research And Development: _____ (WRITE IN) 35/38

4. On average, over the past five years, what proportion of total sales revenues have been spent on research and development as defined above? (If no research and development has been undertaken in this period, indicate "zero".)

_____ (WRITE IN) % 39-40-

5. How many individuals are currently working specifically in the area of software engineering? (NOTE: For purposes of this study, software engineering is defined as: to design, develop or modify software programs/packages in binary machine codes and/or assembly languages.)

Number Engaged In Software Engineering: _____ (WRITE IN) 41/44

(SEE OVER)

6. Please describe any problems you might foresee in recruiting professional, scientific and technical personnel in the 1980's?

THE SECTIONS WHICH FOLLOW DEAL WITH THE SPECIFIC JOB CATEGORIES LISTED BELOW. PLEASE READ THE APPENDIX ENTITLED "ABOUT THE JOB CATEGORIES" BEFORE DECIDING WHETHER OR NOT A PARTICULAR CATEGORY APPLIES TO YOUR ESTABLISHMENT.

	APPLIES TO THIS ESTABLISHMENT YES	NO	
SECTION II--Electrical And Electronic Engineers	1	2	45-
SECTION III--Chemical Engineers	1	2	46-
SECTION IV--Mechanical Engineers	1	2	47-
SECTION V--Chemists	1	2	48-
SECTION VI--Physicists	1	2	49-
SECTION VII--Electronic Engineering Technologists	1	2	50-
SECTION VIII--Mechanical Engineering Technologists	1	2	51-
SECTION IX--Electronic Engineering Technicians	1	2	52-
SECTION X--Mechanical Engineering Technicians	1	2	53-
SECTION XI--Electro-Mechanical Engineering Drafting Technicians	1	2	54-
SECTION XII--Production Workers	1	2	55-

STUDY 08291

5-0
6-3

SECTION III--ABOUT CHEMICAL ENGINEERS

1. How many full-time permanent employees does your establishment currently have in this job category?

Current Number Of Employees: _____ (WRITE IN) 7/9

2. What is your best estimate of the number of full-time permanent employees your establishment will have in this job category at about this time of year in 1983 and 1985?

	1983	1985
Minimum Likely Number	____ 10/12	____ 19/21
Best Estimate	____ 13/15	____ 22/24
Maximum Likely Number	____ 16/18	____ 25/27

3-a) Just to summarize the relationship you envisage between the current level of employment and your best estimate for 1985, please check the appropriate statement below.

(CHECK ONE ONLY)

We Will Have More Employees In 1985 Than In 1981 ..... 26-☐ 1
We Will Have Fewer Employees In 1985 Than In 1981 ..... ☐ 2
We Will Have The Same Number Of Employees In 1985 As In 1981 .. ☐ 3

-b) Please state the assumptions which led to your projection for 1985:

_____

_____

_____

_____

4. How many employees in this job category do you anticipate will retire, leave or otherwise withdraw from this job category at your establishment in each of the following years:

	1981	1983	1985
Number Who Will Leave:	(WRITE IN) 29/31	(WRITE IN) 32/34	(WRITE IN) 35/37

5-a) Have you experienced any hiring difficulties in this job category in the past 12 months; that is, has it taken longer than 3 months to fill a position?

YES ..... 38-☐ 1
NO ..... ☐ 2
OR, HAVE NOT HAD A REQUIREMENT TO HIRE IN PAST 12 MONTHS ..... ☐ 3

(IF "YES", ANSWER PART -b) AND -c). IF "NO" OR "NO REQUIREMENT", SKIP TO Q. 6)

-b) Which of the following reasons best explain why you believe your establishment is experiencing hiring difficulties?

-c) Which reason would you say is the one main reason for the hiring difficulties?

	-b) (CHECK ALL THAT APPLY) REASONS WHICH ARE APPLICABLE	-c) (CHECK ONE ONLY) MAIN REASON
Lack Of Applicants	39-☐ 1	41-☐ 1
Lack Of Applicants With Appropriate Experience	☐ 2	☐ 2
Lack Of Applicants With Appropriate Education Or Training	☐ 3	☐ 3
Some Other Reason(s) Particular To Your Establishment (WRITE IN) _____	☐	☐
Any Other Reason(s) (WRITE IN) ____ ____	40-	42-
.....	☐	☐

ABOUT CHEMICAL ENGINEERS (CONTINUED)

6. What is the minimum educational and/or related experience requirement for which you hired new personnel during 1980 for this job category?

EDUCATIONAL REQUIREMENTS

Completed Secondary School:
Grade 12 ..... 43- ☐ 1
Grade 13 ..... ☐ 2
Completed Trade School ..... ☐ 3
Completed Community College:
1 Year Certificate ..... ☐ 4
2 Year Certificate ..... ☐ 5
3 Year Certificate ..... ☐ 6
Completed University ..... ☐ 7
BSC/BA--3 Year Program ..... ☐ 8
BSC/BA--4 Year Program ..... ☐ 9
MA ..... ☐ 0
PHD ..... ☐ X
Other Post Secondary ..... ☐ Y
44-

RELATED EXPERIENCE REQUIREMENTS:
(IF NONE, INDICATE "ZERO")

Specify Minimum Number
Of Years: _____ 45/46

7-a) How many of the personnel hired in 1980 for this job category came from outside your establishment?

Hired From Outside in 1980: _____ (WRITE IN) 47/49

- OR -

No One Hired From Outside in 1980 ..... ☐

- OR -

No Personnel Added To This Job Category in 1980 ☐

IF YOU CHECKED EITHER OF THESE, SKIP TO QUESTION 8.

50-1

-b) How many of the newly hired outside personnel in 1980 came directly from ... (WRITE IN NUMBER FOR EACH SOURCE. IF NONE, INDICATE "ZERO". SHOULD ADD TO TOTAL HIRED FROM OUTSIDE IN 1980 AS STATED ABOVE IN PART -a)).

A Canadian Secondary School ..... _____ 51/52
A Canadian Community College ..... _____ 53/54
A Canadian University ..... _____ 55/56
Some Other Canadian Educational Institution . _____ 57/58
Another Employer Inside Canada ..... _____ 59/60
From Sources (Any) Outside Canada ..... _____ 61/62
Some Other Source ..... _____ 63/64

ABOUT CHEMICAL ENGINEERS (CONTINUED)

8-a) Please check off which, if any, of the following types of training your company provides for this job category.

-b) For each type of training checked, please specify the average number of days this training would last.

	-a) (CHECK ALL THAT APPLY)	-b) (WRITE IN NO. OF DAYS FOR EACH CHECKED)	
On-The-Job Training	65-☐ 1.....	_____	67/68
Courses Offered By Colleges Or Universities	☐ 2.....	_____	69/70
Courses Offered By Professional Associations Connected With This Job Category	☐ 3.....	_____	71/72
Other (WRITE IN) _____			73/74
_____	☐ 0.....	_____	75/76
- OR -			77/78

NO TRAINING FOR THIS JOB CATEGORY .....
66-

9. On average, what percent of the employees' time in this job category is spent on software engineering, either for your own company or other companies? (IF NONE, INDICATE "ZERO")

Percent Of Employees' Time: _____ % 79/80

PLEASE USE THE SPACE PROVIDED HERE TO MAKE ANY COMMENTS YOU'D LIKE ABOUT THIS JOB CATEGORY; EITHER ABOUT YOUR ESTABLISHMENT IN PARTICULAR OR THE INDUSTRY IN GENERAL:

_____

_____

_____

_____

_____

SECTION XII--ABOUT PRODUCTION WORKERS

1. How many full-time permanent production workers does your establishment currently have?

Current Number Of Employees: _____ (WRITE IN) 7/9

2. What is your best estimate of the number of full-time permanent production workers your establishment will have at about this time of year in 1983 and 1985?

	1983	1985
Minimum Likely Number	____10/12	____ 19/21
Best Estimate	____13/15	____ 22/24
Maximum Likely Number	____16/18	____ 25/27

3-a) Just to summarize the relationship you envisage between the current level of employment and your best estimate for 1985, please check the appropriate statement below.

(CHECK ONE ONLY)

We Will Have More Employees In 1985 Than In 1981 ..... 28-☐ 1
We Will Have Fewer Employees In 1985 Than In 1981 ..... ☐ 2
We Will Have The Same Number Of Employees In 1985 As In 1981 ... ☐ 3

-b) Please state the assumptions which led to your projection for 1985:

_____

_____

_____

_____

4. What percent of your establishment's total employment in 1981 and 1985 do you think production workers will represent?

	1983	1985
Production Workers As A Percentage Of Total Employment:	____ % 29/30	____ % 31/32

5. How many employees in this job category do you anticipate will retire, leave or otherwise withdraw from this job category at your establishment in each of the following years:

	1981	1983	1985
Number Who Will Leave:	(WRITE IN) 33/35	(WRITE IN) 36/38	(WRITE IN) 39/41

(SEE OVER)

ABOUT PRODUCTION WORKERS (CONTINUED)

6-a) Have you experienced any hiring difficulties in this job category in the past 12 months; that is, has it taken longer than 3 months to fill a position?

YES ..... 42-☐ 1

NO ..... ☐ 2

OR, HAVE NOT HAD A REQUIREMENT TO HIRE IN PAST 12 MONTHS ..... ☐ 3

(IF "YES", ANSWER PART -b) AND -c).

-b) Which of the following reasons best explain why you believe your establishment is experiencing hiring difficulties?

-c) Which reason would you say is the one main reason for the hiring difficulties?

	-b) (CHECK ALL THAT APPLY) REASONS WHICH ARE APPLICABLE	-c) (CHECK ONE ONLY) MAIN REASON
Lack Of Applicants	43-☐ 1	45-☐ 1
Lack Of Applicants With Appropriate Experience	☐ 2	☐ 2
Lack Of Applicants With Appropriate Education Or Training	☐ 3	☐ 3
Some Other Reason(s) Particular To Your Establishment (WRITE IN) _____		
_____	☐	☐
Any Other Reason(s) (WRITE IN) _____		
_____	☐ 44-	☐ 46-

PLEASE USE THE SPACE PROVIDED HERE TO MAKE ANY COMMENTS YOU'D LIKE ABOUT THIS JOB CATEGORY, EITHER ABOUT YOUR ESTABLISHMENT IN PARTICULAR OR THE INDUSTRY IN GENERAL.

_____

_____

_____

_____

_____

47/80